Expansion of Open-Ocean Profiling Capabilities for the Detection of Small-Scale Planktonic Structure (DURIP)

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LONG-TERM GOALS

The long-term goal of our research group is quantification of the interactions between small-scale biological and physical processes within the upper ocean. This project has addressed that goal by expanding our technical capabilities for vertical profiling of sub-1m scale bio-optical and physical properties.

OBJECTIVES

Our existing systems for resolution of small-scale planktonic vertical structure have been developed over the past several years for use in relatively protected waters. As we extend our research into open ocean systems, it is necessary to make our instrument systems more robust.

Our experience with cruises off the Oregon coast demonstrated that our existing profiling system could be more effective in addressing questions of small-scale structure through instrumentation improvements in five specific areas:

1) more effective profiler deployment and recovery with a winch that permits “free-fall” while providing rapid profiler retrieval,

2) more bandwidth for multiple high data rate instruments through use of a neutrally-buoyant, fiber optic/ethernet data cable,

3) better resolution of the small-scale horizontal and vertical velocity field around the profiling package with a second acoustic doppler velocimeter,

4) resolution of the small-scale distribution of different zooplankton size classes relative to the phytoplankton layers through use of a multi-frequency acoustic system,

5) more effective archiving and data exchange of processed data through use of a larger workgroup server.

These improvements would yield a more rugged profiling package that could conduct extended time-series of high-resolution vertical profiles of physical and biological properties under a wide range of open ocean conditions.

APPROACH

To meet the needs outlined above, we have added, with DURIP funding, a winch and cable system to our existing profiling system that will permit extended time-series of free-fall profiles to 200m under a wide range of open ocean conditions. The communication of data via the fiber optic cable is enhanced by the addition of a data-multiplexer system. We also added bio-acoustic instrumentation to our system that will permit resolution of small-scale distributions of zooplankton along with our existing capability to resolve the small-scale distribution of phytoplankton. Finally, we have replaced our data server to enhance our data storage and dissemination abilities. This series of instrumentation and infrastructure improvements will enhance our ongoing DOD research and will provide new opportunities for students to use state-of-the-art systems in their research programs.

WORK COMPLETED

The delivery of the completed winch system in late 2002 will complete the equipment acquistion under this DURIP funding. The new data server and disk array is installed and functional. The fiber optic cable has been fabricated. The fiber optic data multiplexer system will be tested with our new cable and winch system during the summer of 2003 on an NSF-supported cruise.

RESULTS

Since the new instrumentation (winch, cable, multiplexer) is still in the process of being integrated into our deployment package, we have no scientific results to report at this time. Results from the use of the bio-acoustics system (TAPS) are reported in the companion annual report for Grant#: N00014-98-1-0094, *Physical/biological dynamics on the finescale: Evaluation of planktonic thin layer processes.*

IMPACT/APPLICATIONS

The new instrumentation will provide new research capabilities for nearshore, continental shelf research as well as open ocean research. Our profiling and data acquisition system extends both the time and space scales of resolution as well as providing integration of multiple instrumentation suites into accessible data sets. The modifications to our free-fall profiling system implemented with this DURIP funding will permit investigation of physical and biological processes on the small-scale (centimeters to meters) across a wide range of ocean conditions. The capability to conduct extended time series of centimeter-scale vertical profiles of this range of parameters will provide a new "window" through which to observe the linkages between physics and biology in the upper ocean. Resolution of these linkages is essential for our understanding of ocean processes.

TRANSITIONS

The incorporation of this new instrumentation into our profiling system extends our ability to define the range of forcing conditions under which small-scale structure is formed and maintained. We will

now be able to work under a much wider range of conditions and in a wider range of locations than was possible with the earlier version of our profiling system.

RELATED PROJECTS

The proposed instrumentation is tightly linked to another ongoing project supported by DOD.

Physical/biological dynamics on the finescale: Evaluation of planktonic thin layer processes - ONR support (N00014-98-1-0094) to Dr. Timothy J. Cowles

This currently-funded project is an extension of the multi-investigator effort to examine planktonic thin layers in East Sound, WA in 1998, and focuses on planktonic small-scale processes over the Oregon continental shelf.

REFERENCES

PUBLICATIONS

PATENTS